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A REPORT

TO

THE SUBSCRIBERS TO A CANAL

FROM

ARUNDEL TO PORTSMOUTH,

&c. &c. &c.

By JOHN RENNIE, Esq.

PORTSMOUTH:

PRINTED BY MOTTLEY, HARRISON, AND MILLER.

1816.

A Report, &c.

London, January 27, 1816.

Gentlemen,

A CANAL, between the Metropolis and Portsmouth has long been a desideratum with the Merchants and Traders of both places. Surveys have been taken of various lines, and applications to Parliament have been made; but owing to objections made by several Gentlemen of large landed property in certain parts of the Country through which the lines were intended to pass, and also the objections of the Proprietors of other Navigations, particularly the River Wandel, the supply of water to which it was apprehended would have been cut off, they have hitherto proved unsuccessful.

The Canal which is now under execution, to form a junction between the Rivers Wey and Arun, will open a communication between London and Arundel, which avoids those parts of the Country where the greatest diffi-

culties arose to the former schemes ; the length of these Navigations, from London Bridge to the Bridge at Arundel, is about eighty-six miles and a half, and can be made complete in all its parts ; from Arundel Bridge, to the Sea at Little Hampton, there is a good Tide Navigation capable of carrying sea-built vessels of a considerable burthen ; but owing to the uncertainty of a Coasting Voyage from Arundel to Portsmouth ; and the loss, detention, and inconvenience which attends the shifting of Cargoes, the transit of Goods between London and Portsmouth cannot be at all calculated on, while a distance, of at least thirty miles is to be performed by Sea ; and therefore, the benefits of a thorough Trade of an Inland Navigation, from London to Arundel, will in a great measure be lost, unless it is continued on from Arundel to Portsmouth, for which the lay or line of country is very favourable.

It was my wish to have followed the line first surveyed in the year 1803, and afterwards improved in the year

1810. This line departed from the River Arun close by the Town of Arundel, and taking a course north of Yapton, and by Barnham, Colworth, Mundham, Chichester, Fishbourne, Bosham, Nutbourne, Emsworth, Havant, and Wymmering, joined the Harbour of Portsmouth at the Flat Houses, being a length of about thirty miles and three quarters; in the whole of which the line of country was most favourable, and there were no heavy pieces of cutting or extensive lines of embankment, and only four Locks were required, there being a summit level of upwards of twenty two miles in length, with a sufficient supply of water, which might have been obtained at a moderate expense. But as his Majesty's Government have recently purchased all the land which is contiguous to Portsbridge, in the Island of Portsea, and thereby occasioned a difficulty, not easily to be surmounted, in one part of the Country through which this Canal must necessarily have passed; and objections having been made by some of the Land Owners and Occupiers between Arundel and Chichester, to this line of Canal, I have been induced, under your directions,

to get another line surveyed, to remove these local objections, which line will also be found to be fully equal to the purpose for which it is intended.

The line, now surveyed, departs from the River Arun at Ford, about two miles and a half below the Town of Arundel, and in the distance of about a quarter of a mile rises to the level of about fourteen feet above the height of ordinary high water at spring tides; from thence it takes a direction by the south of Yapton and Barnham to Lidsey, and through Colworth, Runcton, and Donnington, to the Harbour of Chichester, descending into the Tideway at the Salterns in the Parish of Birdham, and being a length of about twelve miles.

In this line there are several pieces of cutting, one near Yapton of about three quarters of a mile in length; another near Lidsey of about half a mile in length; and a third at Donnington of about a mile in length. There are besides several valleys of some magnitude to embank, one at

Denges Burn, near Yapton, another west of Barnham, one near Lidsey, one at the Sewer dividing the Parishes of Bersted and Oving, and three others of smaller extent, which occasion a considerable expense. This line will have a summit level of about ten miles and a half in length, two Sea Locks, and two others; the expense of the two former, as well as the entrances to them, will be considerable, as they must be made in the Tideway. This line will also, most likely, have to be supplied with water by means of a Steam Engine.

From the Line I have described, a Branch may be made, if desired, from Hunston Common to Chichester, a distance of only one mile and a quarter.

The Navigation from Chichester Harbour is proposed to be made in the Tideway by the Channel north of Thorney Island, and that north of Hayling Island, into Langston Harbour; the depth of water, in both channels, being sufficient at low water, except at the places marked

A and C on the Plans. In the line north of Thorney Island, about a mile and a half in length will require to be deepened. In that north of Hayling Island two lines have been laid down, one marked B, by which the length will be shortened about a quarter of a mile, the other marked C, which is the present line of deepest water; the former of these will be rather more expensive than the latter; but as it will be more convenient, on account of the Navigation, perhaps it should be preferred: the expense of deepening these Fords will amount to about £12,914. The Channel of Langston Harbour is deep from the place above mentioned to Eastney Lake, which departs from the Harbour at the point north of Cumberland Fort, where the Ferry to Hayling Island now is. The Channel of Eastney Lake is deep to near the Convict Watering Place. From this Lake therefore I advise a line of Canal to be made across Portsea Island, to the Halfway Houses in Portsea Common, a central point between the Towns of Portsmouth and Portsea; and if a Basin is made at this place, it will be a convenient depot for both: the length

of this Cut is about two miles and thirty-two chains, its rise above the level of the top of ordinary spring tides is about thirteen feet, which will be effected by two Locks, and as there is no water to supply the Lockage to be procured in the Island, it must be supplied by means of a Steam Engine.

It is proposed to make another Cut between Portsmouth Harbour and Langston Harbour, by Wymmering, for which the ground is very favourable, and the distance only one mile and twenty-four chains. This Cut is intended to be made at least eight feet deep, under the level of the ordinary high water of Spring Tides, in order that it may be navigated at the high water of Neap Tides; and as it will be filled by the Tide, it will only require a Lock at each end, and no Steam Engine.

It will appear, by the annexed Estimates, that the probable expence of the Line from the River Arun, at Ford, to Chichester Harbour, at Birdham, amounts to

£72,270. The deepening of the Channels of Thorney and Langston, £12,914. The cost to the Half-way Houses, at Portsea, including the Basin, £18,618. The Canal from Langston Harbour to Portsmouth Harbour, £15,188.—Making a Total of £118,990.

In the former part of this Report I have stated the length of Navigation already made, or in a state of forwardness, between London Bridge and Arundel Bridge, at $86\frac{1}{2}$ miles; and the departure of the proposed Canal from Ford, being $2\frac{1}{2}$ miles below Arundel, will make the total of this length amount to 89 miles. From Ford to the proposed Basin, at Portsea, will be 28 miles, making a total distance between London Bridge and Portsmouth, of 117 miles, which is only about five miles longer than the Canal, proposed to be made from London to Portsmouth, in the year 1803. If, therefore, the former Line was likely to be a profitable concern when the difficult parts of the Country about Merstham, Smallfield Place, and Faygate, were included; surely the Line now proposed,

when none of these expensive works are included, ought to be more profitable to the Subscribers to the Line from Arundel to Portsmouth; and as I have no doubt, when the Wey and Arun Canal is compleated, the Proprietors of the River Navigations, with which it communicates, will improve their respective Navigations, I trust, therefore, the Trade through this intended Navigation will give an ample return to those who may be inclined to adventure their money on the project: while to the Merchants of London and Portsmouth, as well as to the Traders in all the Towns near which this Canal will pass, and to the Country in general, the advantages will greatly exceed any reasonable calculation that may be made.

Goods may be sent from London, and proceed without interruption to Portsmouth. The Barges will be towed by horses until they reach Chichester Harbour, and from thence to the Line of Portsea, in the Tide-way by Steam-boats; and as this Tide-way will always have a sufficient depth, even at low water of Spring Tides,

the Navigation will be as regular as on a Canal.— Instead, therefore, of goods being sent Coast-ways between London and Portsmouth, Havant, Emsworth, Chichester, or Arundel, there can be no doubt, that they will be sent by this Line of Canal. Naval and Military stores will likewise form great articles of trade, as well as East and West India goods, particularly in the time of War; and when to these the local trade is added, I think it cannot fail to give an ample return for the money it is likely to cost.

I am, Gentlemen,

Your most humble Servant,

JOHN RENNIE.

*To the Subscribers to a Canal from Arundel
to Portsmouth, with a Cut from Lang-
ston Harbour to Portsmouth Harbour.*

ESTIMATE of the probable Expence of the proposed
PORTSMOUTH and ARUNDEL CANAL.

FIRST DISTRICT.

The Canal to be 19 Feet 6 Inches wide at Bottom, 33 Feet at Top, and 4 Feet
6 Inches Deep.

From Ford, near Arundel, to Chichester Harbour.

To cutting and forming the Canal from the River Arun, at Ford, to the Valley at Denges Burn, near Yapton	£ 4149
To Embanking Valley at Denges Burn	1677
To making Canal from said Valley to a Valley West of Barnham....	598
To Embanking of said Valley	3683
To making Canal from the above Valley to a Valley near Lidsey, and Embanking said Valley.....	1200
To making Canal from ditto to Valley at the division of the Parishes of of Bersted and Oving	989
To Embanking said Valley	2638
To making Canal from ditto to Hunstone Common.....	2044
To Embanking at Hunstone Common	385
To making Canal from thence to the Tideway at Berdham.....	10,742
To two Sea Locks and two others.....	11,100
To six main and thirty occupation Road Bridges.....	9300
To four large and twelve small Culverts	1000
To Towing Path and Fencing	2898
To purchase of Land	7680
To a Steam Engine, Engine House, &c.....	2760
Contingencies.....	9427
	£72,270

ESTIMATE of the probable Expence of Deepening Wadeways
at Thorney and Langstone.

	£.
To Deepening Thorney Wadeway	4970
To Ditto Langstone Wadeway	5800
Contingencies.....	2144
	<hr/>
	£12,914

ESTIMATE of the probable Expence of making a Canal from
Eastney Lake, in Langstone Harbour, to the Halfway-houses,
in Portsea Common, including a Basin at ditto.

	£.
To Cutting from Eastney Lake to the head of the second Lock	1163
To Ditto to the Basin at Portsea.....	2238
To two Locks	4600
To three roads six occupation Bridges.....	2680
To Forming and Fencing the Towing Path	583
To purchase of Land	1800
To Steam Engine	2452
To Basin and Contingencies.....	3102
	<hr/>
	£18,618

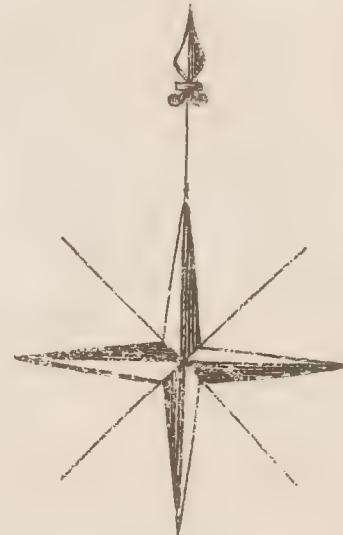
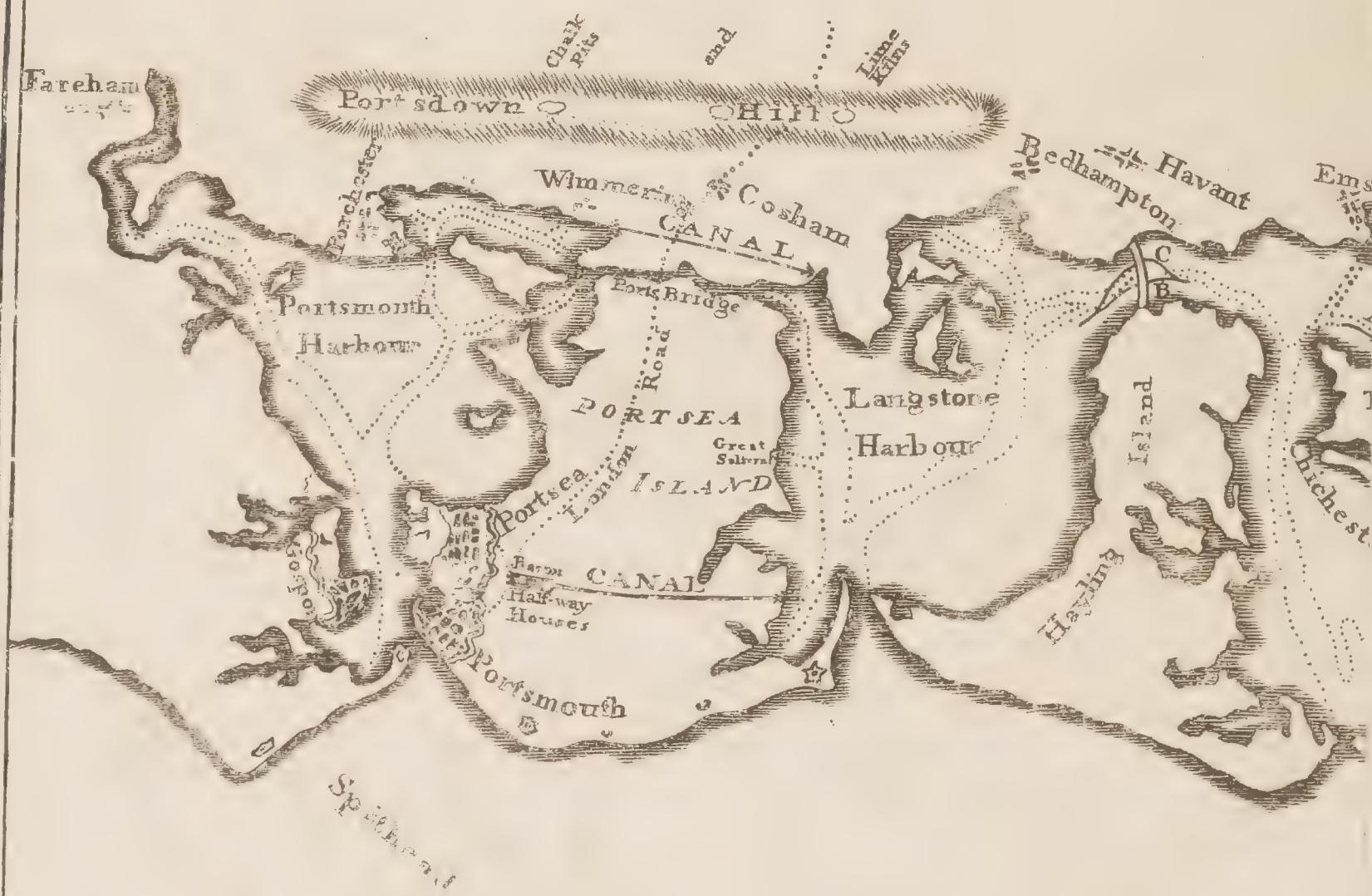
In the above Estimate nothing is allowed for the purchase of Ground for Storehouses, or for the Storehouses themselves, as it is understood these will amply pay for any expence that may be incurred; and their extent will depend on the quantity of goods that may be stored.

ESTIMATE of the probable Expence of making a Navigable
Canal from Portsmouth Harbour to Langstone Harbour, by
Wymmering.—Depth, 8 Feet.

	£.
To Cutting.....	5831
To two Locks	5000
To one Road and three occupation Bridges....	1160
To Forming and Fencing the Towing Path....	316
To Land.....	900
Contingencies	1981
	<hr/>
	£15,188

RECAPITULATION.

	£.
Canal from the River Arun, at Ford, to Chichester Harbour, at Berdham.....	72,270
Deepening Wadeways at Thorney Island and Langston Harbour	12,914
Canal from Eastney Lake to the Halfway-houses, in Portsea Common	18,618
Canal from Portsmouth Harbour to Langstone Harbour	15,188
	<hr/>
	£118,990





DIRECTION of the LONDON and PORTSMOUTH CANAL from the latter place as far as ARUNDEL.

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The causes of the opposition of the Committee of Navigation
of the City of London to the erection of Pound Locks & Weirs by
the Commissioners of the Upper Districts are the following
Apprehensions. —

1. That the Weirs will not only be unnecessary & useless
for the Pound Locks, but
2. That their operation will be detrimental to the
Navigation of the River within the City's Jurisdiction
because they will deprive the Flash or supply of water
in short water time of its Effect. —

There exists a marked difference between the
construction of a Canal & the mode of rendering a River
useful to Navigation. This difference arises from
this circumstance. That the water in Rivers flowing
down on an inclined Plane acquires a Velocity &
consequently an action upon the Soil which composes
the Bed of a River which the water of a Canal
being on a level never receives.

The quantum of this Velocity depends not only
on the general inclination of the Plane of the River

not only in certain places on its peculiar Inclination, not only on the peculiar Soil of the Bed of the River but also on the natural contraction of the Sides & Elevation of the bottom of the River. - The knowledge of all these Circumstances must depend on long & intimate acquaintance with the River, which constitutes Experience with respect to that River, & therefore on this general ground it may be asserted that the Commissioners Surveyors who not only direct the Works but superintend the Execution of them are much more able to judge of the Expediency necessary for the Improvement of the Navigation of the River Thames than the most able Engineer, who in making a Canal makes a River of his own, & who can answer for the probable Effect of it, because he entertains no apprehension from the difficulties which arise in a River, from the variability of the Velocity of the water.

The source of the River Thames is in a Chalky wold, the Rivers which aggregate the

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Water of the Thames arise from Chalky Hills. The Country through which the River flows is of a similar nature. - The Stones which are stratified in chalk hills are of the Siliceous Genus, or Flints, these being washed down by Rains & rounded by the attrition of the water compose what is called gravel. - The bottom of the River is generally speaking Gravel upon Clay. - From the Section made by Brindley its appearance is similar to a series of Curves & in the production of these curves the regular Progression is, that where the River is contracted the water flows with great Velocity & makes a deep water with a shoal at its Extremity, owing to the diminution of the Force of the water by its Expansion; and that Shoal is always greatest in proportion to the width of the River, as the water is always deepest in proportion to the Contraction.

Such then being the natural operation of the water on the loose gravelly bottom of the River the first artificial Modes (for Art is only the Imitation of Nature) of making deep water;

for whatsoever purpose it was wanted; was by contraction of the Sides or Elevation of the Bottom of the River. Two instances which are familiar to every navigator on the Thames, will illustrate my observation.

1. with respect to the Contraction of the River. - On the Banks of the River near Teddington is a large Common Meadow where great herds of Cattle are accustomed to graze; in summertime they are tempted by the coolness of the water to go midleg high into the Stream the Effect is that the water is pumped up or dammed and this mode of pumping, not unfrequently of great ^{service} to the Navigation is known to Bargemen by the name of a "Cow Flash"

2. with respect to the Elevation of the Bottom - with the highest respect for Mr. Penn's abilities I cannot but quote a passage from his Survey which shows an Ignorance (arising solely from inexperience) of a common Cause & a common Effect. "The long drought which preceded my

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"Observations on the River was so far a favorable Cir-
"cumstance as it is known the Water action is a lesser
"stroke than is usual at this season of the Year but
"the uncommon quantity of weeds which I found in
"the River, in a great measure counteracted the advantage
"arising from the Deficiency of Water; for the weeds
"confine or bind up the Water as it were on each
"side of the Barge Tract like so many Jetties - - -
"indeed from what I can tell by Bergman, 2
"Ferrymen others these weeds act to a much greater
"degree than a Stranger could conceive" p: 8

(Report of a Survey of the Thames)
Printed July 30 1794.

That the operation of the weeds is to elevate
the bottom of the River may be fully proved, because in
the night time when the weeds like all other plants
droop & bow their heads the water of the River runs
off with greater velocity than in the day time.

But these general Experiences are not here
brought forward as the sole proofs of the opinion
I wish to establish; these general Experiences have
been substantiated & the result of them elegantly

expressed by Mr. Jeffery; what is of more consequence, are confirmed by Historical Facts. Mr. Jeffery's words are as follows: "The Depth of water that can be acquired in the natural stream of a River of a given width depends on two circumstances, the quantity of water, & the declivity or fall. — where the quantity is sufficient & a want of depth is caused by too great a width, the depth may be increased by increasing the width without altering the declivity, but that increase will not exceed certain limits, & the next step to procure a further increase, depth is to lessen the declivity by means of Dams or Levers" (Mr. Jeffery's Report, p. 4.)

The Historical Deduction is curious & important as Mankind always supply their own wants before they can raise any Superfluities to barter for those of their Neighbours, it is not surprising if the water of the River was applied to the use of Mills previous to its application to the purposes of Navigation.

To drive a Mill it is necessary that the water at the Head should be considerably higher than that

below, & to produce this Effect the first rude attempt
was by Piling Stones or making a bank diagonally so
as to contract the Stream. — Perhaps this will be better

explained by Fig. 1. C. F. & T represent the Banks of
the River B B B the Diagonal bank A the Mill.

P. 17
The surface of the Water at (a) will be as much
higher than the surface of the water at (b) as the
surface of the at (c) which is on a level with that
at (a) would be by the natural course of the River
above the surface at (b) or in other words equal
to the fall of water from C. B. to T. F. —

It was found after a very little Experience that this
mode of partial Contraction by the diagonal Bank
did not succeed so well as a general Stop would do;
because although the water at the Mill Head was
always in the same Ratio of height to that at its
fall, yet the mill wheel being fixed & the par-
tial contraction not remedying the Deficiency in
the low water time, the Mill Head was not of
an adequate depth to give the necessary Momentum

to the Mill whil. — The next step therefore in addition to the Contraction of the sides was to elevate the bottom of the River, so that the water might be maintained at a sufficient depth in all seasons, and therefore the Mill was so constructed that the Depth of Water at its Head might be always equal to that at the Head of the Mill. It was at the same time found necessary to provide against the superfluity of water in winter & therefore the weir was not only not made so high but that the superfluous water might run over it; but it was also entirely moveable to give ample vent to the water in times of flood. & about the same period the Trade of the River became of sufficient importance to justify

some attention to its Navigation & the Mill Owners finding that the Navigation would increase the value of their property, the occasional opening in the middle originally adopted only for the discharge of the superfluous water, was used for the passage of the Barges which descending with great velocity required

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sufficient Momentum to carry them over the Shoal
always attendant on the Deep water at the Tail of
the Weir, or was tracked up against it by the Effort
of Men or Machines. A Mill and Weir may be
seen in Fig. 2.

In this inconvenient & dangerous Method it is obvious
that much water was expended in the passage of a
Single Barge through the Weir then called a Flash
or Fresh Lock, consequently in short Water time the
accumulation of Water was limited in a space of
time of but a purpose disproportionate to its real
utility. ^{and} ~~and~~ ^{but} by the bye let it be remembered
that Pond Locks are not intended to obviate the
use of Flashes (of which we shall speak presently)
but to prevent the waste of water by them, as much
water being used in the Old Flash Locks for the
passage of a Single Barge as is now required for the
use of ten by the Pond Locks. The Pond Locks con-
structed by the Commissioners in 1772-3-4 were
erected so near to the Old Weirs that they might be
reconverted to the use for which only they were fit,

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and instead of being the principal might become only the auxiliary to Navigation. Fig. 3 is intended to shew the relative dimensions of the Mill Weir and the Pond Lock: - If the original use of the Weir is considered it must be allowed that any Water suffered to run waste through it will reduce the height of water at the Millhead, the Millhead is on a level with the head of the Pond Lock, and it is found by Experience and Comptained of by Mr. Remond in his Report p. very justly that the Millars work their water so low as to affect the Head of the water at the Pond Lock, consequently a diminution of water at the weir will be a diminution of water at the Head of the Pond Lock and therefore a weir is necessary to a Pond Lock on a River Navigation in low water time.

Having thus established the first general Principle which I consider as a sufficient answer to the first cause of objection by the Committee of Navigation of the City of London. I shall proceed to demonstrate first that the situation of the River above the proposed weirs justifies the specific

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Plan of the Commissioners and Secondly will not be prejudic^{al}
to the Navigation of the River ~~Thames~~ within the Jurisdiction
of the City of London -

First the navigable depth of water on the Thames is found
by experience to be four feet, therefore the Barges are limited by the
Act^s of Parliament to draw only three feet ten inches of water.

The object of the Commissioners in their attempts to improve the
River is therefore to produce a depth of four feet at all times.

In low water time there are four shallows or places where there is
less than four feet of water between Boveney & Southwpe; there is
another shallow above Windsor Bridge, and a continued shallow
from a small distance below Windsor Bridge to near the Black Potts
Cyt. - Now the mode of remedying these Inconveniences must be either
by ballasting, a species of Contraction or by elevating the Bottom of
the River by putting in some Stop or Weir below the shallows, so
as to maintain the water at a sufficient depth on the shallows.

The mode of Contraction by ballasting has been tried & found
ineffectual. & the Commissioners therefore think it necessary
to apply the other mode by erecting Weirs similar to the old
Flash Locks, or Weirs, but of improved Construction.

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The Commissioners therefore relying on the Experience of their Surveyors who know the fall of the River, conceive with propriety that the upper Weir will pen the the water in low water time sufficiently to carry the Boats over the fair Shallows between Booveney & South Hape and that the Lower Weir will make an adequate Head of water to carry the Boats over the Shallow near Alindor Bridge and maintain a similar Head at the Pond Lock to be Erected in the Kings Engine Stream.

If then the upper Weir is executed according to the Plan it is required to know in low water time in what space of time the water would rise to the depth of four feet.

Let the Line A B. in Fig. 4 represent the bottom of the River C D. The Surface of the water where only two feet in depth or two feet below the Navigable Depth. If the Floodgate or Weir of four feet be shut down it will stop the Current till the water rises to E. and as the mean fall of the water in the River is 2 feet to a Mile it will pen one Mile from C to C.

The Quantity of water then necessary to fill up the space of the Triangle C C D will be as follows. -

Length from C to D one Mile at one foot mean

13.

Half a Mile at 2 feet mean depth = 880 Yards = 2640 Feet.
multiplied by 200 feet the mean width of the River, multiplied
by two feet the mean depth = 356,000 Cubic feet of water
and as the general Current of the River is two Miles in an hour
that is to say two Miles in length of a Volume of water ca-
pable of maintaining the River in a Navigable State flows
by a given point in a hour. - The space C. C. D being a
quarter of that Volume will be at the height of four
feet in one Quarter of an Hour.

Having thus proved the actual retention of the water I owe
it to truth and Justice to mark with pointed Indigation
the inconsistency of that man who now objects to the retention
of water by the Commissioners Weirs; who was last Year the
Advocate of a Canal which was to be constructed of such a
Capacity as to hold 30,096,000 Cubic Feet of water or
Thirtyfive times as much as the Commissioners Weirs will
retain, which water was never to return into the Thames, where
it was wanted, but to be entirely diverted till it came into
the Tideway, and is now the promoter of another Canal which
will intercept a stream of water of which the half at least

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will never return into the Thames but in a similar manner

My objection to the Boulter's Lock Canal was never on
this ground I considered even this waste of water as of no con-
sequence I will detain you but a short time on the second
proof because it depends on a matter familiar to your obser-
vation. - The water of a Pail thrown from a high place
although it pours in a ~~tenacious~~ volume at the Mouth of
the Pail yet by the resistance of the air it is so frittered
away that the nearer it approaches the ground the more it
resembles a small Shower and this diminution of Volume
is always in exact Ratio to its Distance from the Earth and
therefore water when let loose after being retained is more
tenacious or Voluminous the nearer it is to its point of
detention.

By the retention of water at the Weirs Flashes, or an
artificial depth of water sufficient to contain the Barges
is obtained.

These Flashes are made by closely shutting the water in
at the Mill Head, the Weirs and Flash Locks, then
become a compleat stop to the current of the River, the
water of which soon becomes of an adequate depth; during

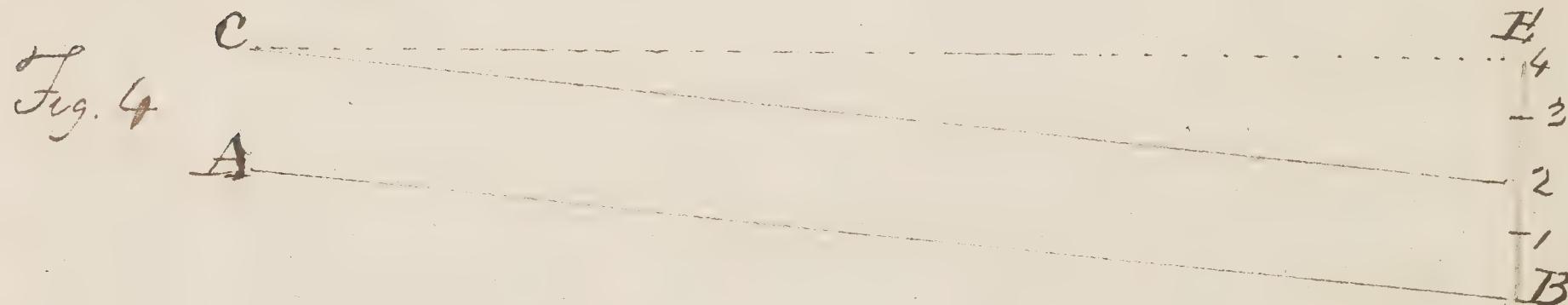
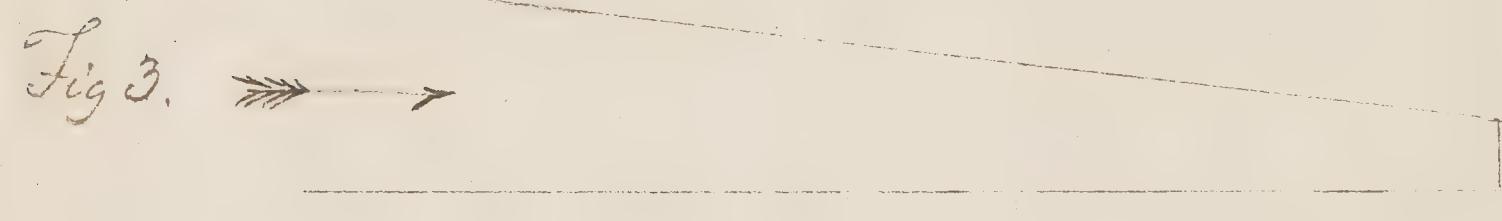
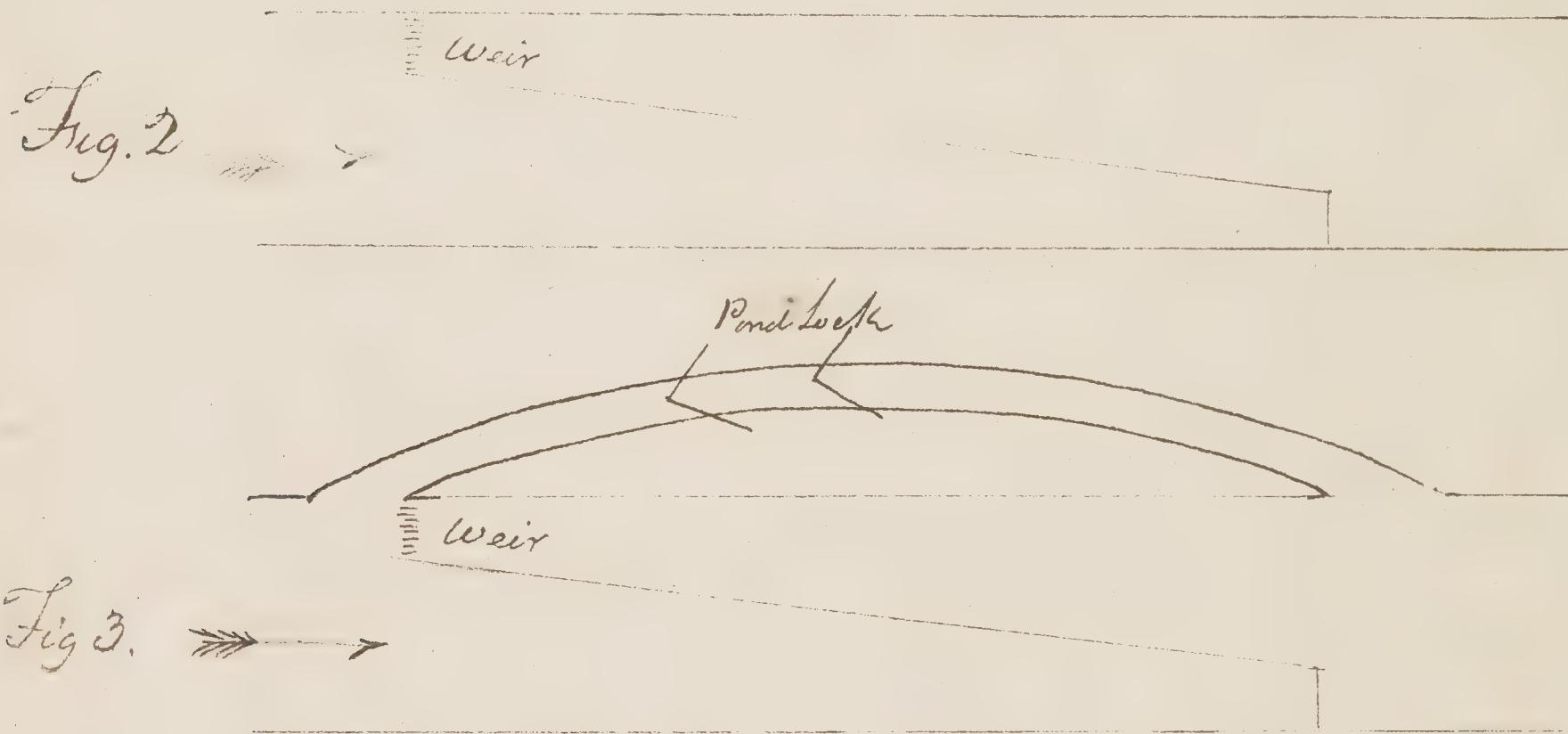
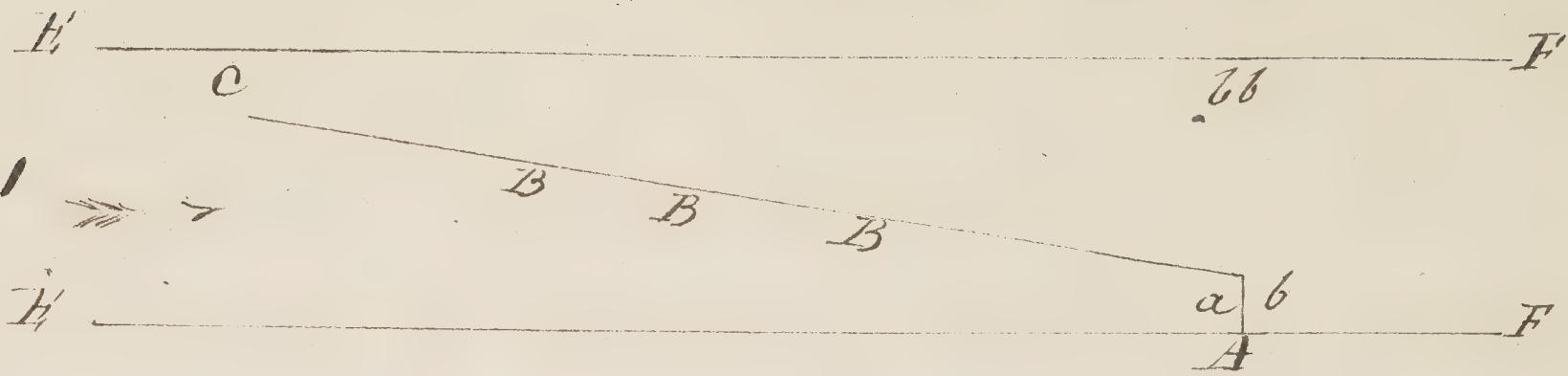
the time the water is obtaining such an adequate depth
the Barges pass through the Pond Lock and descend into
the River below the Weir (the Pond Locks, do not pass
any water but are intended merely to admit the Barges
to pass without violence & to prevent the unnecessary waste
of water) when the Flash is at best the Mile & the Weirs
are thrown open, the water descends with an increased
velocity soon overtakes the Barges & carries them to the next
weir below where a similar operation commences.

The obvious conclusion therefore is that the Flash water
from its retention at the Commissioners Weirs will descend
in a considerable volume or body because the tenacity of
water being greatest the nearer it is to the place of its
discharge & the Commissioners Weirs being unincumbered
with mills, Fisheries &c. and other inconveniences to the
Navigation; the nearer those weirs are brought to the
City's Jurisdiction the greater will be the effect &
velocity of the Flash, & consequently the erection of
of the weirs will not only be prejudicial but rather
of great utility to the Navigation of the River Thames,

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within the Jurisdiction of the City of London.

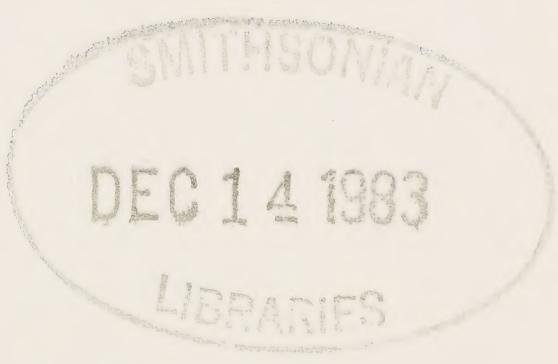
April 4th 1795

(Signed) Fredk. Page



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1265B
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NMAH

Page, F.
Causes of the
opposition of the
Committee of
Navigation of the
City of London to
the erection of
pound lock & wiers..
* Manuscript.
1795.



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The causes of the oppositon of the Commi

